CONFINED SPACE RESCUE

SPOKANE COUNTY RESOURCES

STRATEGIC MANAGEMENT OF CHANGE

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ABSTRACT

This research project identified the available fire service resources and capabilities within Spokane County for confined space rescues. The problem was that the Spokane Valley Fire Department did not know what resources were available, their capabilities or from where they would come if they were needed in relation to their county wide mutual aid agreement. The purpose of this project was to identify the number of personnel and their training levels, the equipment that was available and the corresponding capabilities.

The research employed both historical and descriptive research (a) to identify what equipment was available for confined space rescue within the Spokane County fire service agencies, (b) to identify what the fire service confined space rescue training levels were, and (c) to identify what the fire service confined space rescue capabilities were in Spokane County?

The principal procedures used were a literature review of the statutory requirements, the applicable National Fire Protection Association standards, and of information on training levels and the types of equipment available. A survey and interviews was also conducted of the 23 fire service agencies in Spokane County.

The findings of this research were that Spokane County had considerable resources and capabilities available for confined space rescue, both in personnel and equipment. These findings were compiled in an Appendix.

The recommendations resulting from the research include (a) educating the Spokane County fire service agencies so that they may become compliant with state and federal mandates, (b) continue awareness training until all of the fire personnel are

trained to that level, and (c) distribute the information gathered from this research so that all the agencies will have an understanding of the current resources available to them form their mutual aid partners. .

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INTRODUCTION

The Spokane Valley Fire Department (SVFD) recognizes that there are hundreds of confined spaces within its jurisdiction and it further recognizes that Spokane County has thousands. The Spokane Valley Fire Department has mutual aid agreements with the 11 cities and 12 fire districts within Spokane County but does not know the capabilities of their personnel or resources available to respond to confined space rescues. The confined space rescue problem in Spokane County is growing and the number and severity of incidents is increasing. The problem was not having knowledge of the other fire service agencies personnel's training and material resources available to the Spokane Valley Fire Department within the mutual aid agreement.

The purpose of this research project was to identify the available fire service resources, personnel and material, and their capabilities for both responding to and mitigating confined space rescues within the SVFD and Spokane County. Descriptive research methods were supported by historical research to answer the following questions:

1. What equipment is available for confined space rescue within the Spokane County fire service agencies?
2. What are the fire service confined space rescue training levels in Spokane County of its personnel?
3. What are the fire service capabilities in confined space rescue in Spokane County?

BACKGROUND AND SIGNIFICANTE

Spokane County covers an area of one thousand, seven hundred and sixty four square miles with a population of 414,500 as of April 1999 (Washington State, 1999). Within this area are also approximately sixteen thousand business occupancies, many of which have confined spaces. These businesses are very diversified, including agriculture, heavy industry, manufacturing and transportation to identify a few. The confined spaces that they possess are just as varied. Many of these occupancies have boilers, vats, cisterns, hoppers, dry wells, rail cars, tanks, and utility vaults, all of which can be confined spaces. How many of these confined spaces contained other hazards, which make them, permit required are mostly unknown.

The hazards of confined spaces have been acknowledged throughout history. In 1556, Agricola noted that breathing difficulties in mines was caused by stagnate air and that a fire in a mine would bring swift death to those that remained. Alice Hamilton, in 1925, also observed that deaths from asphyxiation were being caused by hydrogen sulfide produced by decomposing organic matter in vats, manholes, and tanks (Pettit,T., Braddee,R., Suruda,A., Castillo,D., and Helmkamp,J.,1996).

In 1979 the Occupational Safety and Health Administration (OSHA) began the process of addressing the injuries and fatalities that were occurring in confined spaces in this country. Issuing an advanced notice of rulemaking for confined spaces started the process. Over 13 years later OSHA adopted the final rule. In January 1993, 29 Certified Federal Register (CFR) parts, 1910.146, for permit required confined spaces was adopted (Mansdorf, 1995).

Washington State is an OSHA plan state. This requires Washington State to meet or exceed the OSHA standards. The current standard that has been adopted for confined spaces is Washington Administrative Code (WAC) 296-62 Part M (2-95) Confined Spaces. This WAC contains the minimum requirements for practices and procedures to protect employees and rescuers in all industries from the hazards of entry and/or work in permit required confined spaces (PRCS) (WAC, 1995).

Washington State has further identified the requirements for confined space rescue by fire service agencies in its vertical safety standards for firefighters. WAC 296-305-05003 (7-96) Confined Space Rescue Operations was adopted and it identifies the requirements of rescue agencies that will respond to confined space emergencies (WAC 296-305, 1996).

The requirements on the fire services that will respond to confined space emergencies were further defined by the adoption of the National Fire Protection Association (NFPA) 1670, Standard on Operations and Training for Technical Rescue Incidents, 1999 Edition, Chapter 5 – Confined Spaces. This NFPA standard, even though it is a consensus standard and not a mandated requirement, clearly defines the training and competencies needed to safely perform confined space rescues (NFPA 1670, 1999).

The SVFD has defined its role within our jurisdictional boundaries with its mission statement,“ The Spokane Valley Fire Department is an all-risk emergency agency, protecting its citizen’s lives, property, and the environment through a cost effective and responsive people oriented service” (SVFD, 1994). This mission includes confined space rescue with a designated rescue team. Because we have mutual aid agreements

with all of the other 23 fire service agencies within Spokane County we can be called to assist them in a confined space rescue emergency or request assistance from them.

The Spokane County fire service agencies respond to over 26,000 emergency responses per year. To effectively accomplish our mission and provide a coordinated response within a mutual aid system, it is necessary to understand the available resources and the abilities of the personnel responding within the county. For the SVFD to effectively manage its resources and plan for the needs within its jurisdiction it also needs to know the resources that it can expect to receive.

The confined space problem is growing within Spokane County. The SVFD is currently identifying its confined spaces through an inspection program. It is also training personnel and purchasing the equipment needed to be prepared for confined space rescues. The information gained from a review of the other resources available within Spokane County will be valuable to the SVFD in its planing and response preparedness.

This type of identification and analysis of the existing situation was one of the topics discussed in module two of the change management model in my Strategic Management of Change class at the National Fire Academy in February 1999.

LITERATURE REVIEW

The literature review for this applied research project was primarily focused on identifying the information needed to develop a survey. This survey was the primary tool used to gather the information needed to answer the research questions. The review was focused into three main areas; training requirements or recommendations,

equipment needs, and the capabilities needed to perform confined space rescues effectively.

Confined space rescues are a uniquely demanding fire service rescue problem. After the Loma Prieta Earthquake in late 1989, increased attention was focused on the response capabilities and the specialized resources and training that is required in technical rescue situations. The outcome of special rescue responses relies heavily on the training of personnel and if they are adequately equipped (Naum, 1994). Recognizing and addressing the federal, state and local requirements and the consensus training standards of the National Fire Protection Association that apply to specialized rescue situations like confined space can reduce your potential liability. Many of these standards dictate your methods of operation on the rescue scene (Reimer, 1996).

A review of the mandated federal and state regulations found that there were three that apply. Washington State is an OSHA plan state. This requires Washington to meet or exceed the federal requirements of 29 CFR, Parts 1910, Permit Required Confined Spaces for General Industry. Washington has satisfied this requirement by adopting its own regulations for confined spaces, Washington Administrative Code 296-62 Part M, Confined Spaces, General Occupational Health. There is also a fire service specific regulation, WAC 296-305, Confined Space Rescue Operations, Safety Standards for Firefighters.

WAC 296-305 (1996) outlines the training requirements for rescue situations. Personnel are required to train and practice making permit required confined space (PRCS) rescues at least once every 12 months. There is also a required size-up that

must be incorporated into the training. This size-up must include; identification that it is a confined space, assessment of any documentation of the space, identification of location and number of victims, the potential hazards, and determination if the situation is victim rescue or body recovery (WAC 296-305, 1996). If the fire department has any confined spaces on its own facilities or accepts confined space rescue responsibilities from contracted spaces then the training and regulations become more demanding. At that point the training requirements are at levels defined as attendant, entrant, and supervisor, and the full training requirements of part M apply (WAC 296-62, 1995).

A review of the NFPA Standards identified many that pertained to confined space rescue. NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents 1999 Edition, is the overriding consensus standard for confined space rescue. Within NFPA 1670 many other NFPA Standards are referenced. The training and competencies of NFPA 1670, chapters 2,4,5, and 9-3; NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, sections 6-4, 6-5, and chapter 8; NFPA 472, Standard for Professional Competence of Responders to Hazardous Materials Incidents, chapter 2; NFPA 1521, Standard for Fire Department Safety Officer, chapter 4; and NFPA 1561, Standard on Fire Department Incident Management Systems, chapters 2, 3, and section 2-6 are all referenced by NFPA 1670.

NFPA 1670 (1999) identifies the training and competency requirements by separating the levels into awareness, operations, and technician. These are different than the training requirements of WAC 296-62 (1995), which defines the training as entrant, attendant, and supervisor. The primary difference between the regulation and the standards are that NFPA standards work with competencies and knowledge, and

the WAC defines it as responsibilities. The requirements under WAC take precedent because they are mandates, but it is also recognized that the requirements of a consensus standard need to be adhered to. The definitions and competencies are much more defined within NFPA 1670.

NFPA 1670 identifies many of the training requirements within other NFPA standards. The responder to a confined space rescue should be trained to a minimum at the awareness level by NFPA 472. This training and competencies will need to include the ability to identify the hazardous materials involved, use and understanding of the Emergency Response Guidebook, and identifying basic information from Material Safety Data Sheets NFPA 472 (1997). NFPA 1561 (1995), establishes the minimum training required to function as part of a command structure and to work within a personnel accountability system. This training includes communications, terminology, understanding the incident management system, and being capable of utilizing it.

NFPA 1670 also describes the necessary training and competencies of the safety aspects of rescue situations. In NFPA 1500 (1992) they define the need for rapid intervention teams (RIT) and the need to have two trained personnel outside to assist if needed. WAC (1997) also mandates having two trained personnel acting as a RIT at confined space rescues. NFPA 1500 also defines the training needed to work safely on scene, infectious disease control, personal protective equipment, self-contained breathing apparatus, and scene control.

There are many other training needs identified in NFPA 1670, including the need of understanding and being proficient in the use of all the specialized equipment, the

need for rope rescue training and trench rescue training since many times these disciplines also come into confined space rescue situations.

Minter (1994) explains that there are several questions that need to be answered before you can decide if a fire department is capable of performing confined space rescues. He suggests that you need to know, who gets training, how much, how often, where do they get it? Do they have specialized equipment, will it work, and was it designed for rescue?

The training and demands on a confined space rescue team are very comprehensive. There are no training hour requirements however most rescue professionals agree that the minimum training should be 40 hours and that 80 hours would be preferred for confined space rescues (Roop,M., Wright,R., and Vines,T., 1997). There are also no requirements for how many personnel need to be trained or to what levels but it is recognized that these regulations were brought about as a result of the many fatalities involving would-be rescuers. Responders need to be trained to at least the awareness level, be able to identify the incident as a confined space rescue, and summon the appropriate help (Roop et al, 1997).

The equipment requirements can be as varied as the spaces that may be encountered. Accardi (1996) gives an example of the type of tools being developed for specialized rescue like the Uni-Hoist. The Uni-Hoist is a metal arm with a man rated winch that can be used at many angles. This tool along with winches, tripods and rope equipment make up the retrieval systems needed to make entry into confined spaces. The capabilities of these retrieval systems both in reach and weight capacities have a great deal to do with the success of the rescues.

The requirements on the rope systems that will be needed, care and maintenance of the equipment, safety factors to be considered, and policy and procedures are identified in NFPA 1983, (1995). NFPA 1983 established a safety factor of 15 to 1, which sets the requirement for the strength of ropes to be used.

Many other types of equipment are needed to effect a safe rescue. There is considerable literature with information and sales promotions for lighting systems, ventilation blowers, air monitors, harnesses, intrinsically communication systems and breathing apparatus. The equipment needs to be adequate for the hazards that may be involved and the capabilities that the agencies want. The mandates and consensus standards that pertain to confined space rescue are many, and the equipment that is available to the rescue teams is constantly improving and changing.

PROCEDURES

Definition of Terms

Material Safety Data Sheet (MSDS). " A form, provided by manufacturers and compounders (blenders) of chemicals, containing information about chemical composition, physical and chemical properties, health and safety hazards, emergency response, and waste disposal of the material as required by 29 CFR 1910.1200" (NFPA, 1993, p. 125).

Confined Space. Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (For example, tanks,

vessels, silos, storage bins, hoppers, vaults, and pit are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

(WAC 296-62, 1995, p. 2)

Permit Required Confined Spaces means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slops downward and tapers to a small cross section; or

(4) Contains any other recognized serious safety or health hazard.

(WAC 296-62, 1995, p. 4)

Research Methodology

The desired outcome of this research project was to identify the fire service capabilities in regards to confined space rescue within Spokane County. The training levels of the personnel involved and the equipment resources that are available define those capabilities. The research was both historical and descriptive. Historical research was conducted by a literature review, which examined the federal, state and local statutory requirements involving confined space rescue. The NFPA Standards were reviewed to identify those that defined the training and competencies accepted by that organization with regard to confined space resources and entries, and a review of

current commercial literature was also done to identify views of various authors in the area training and equipment.

Following the literature review and the identification of the applicable statutory requirements, consensus standards, and information a survey was constructed and sent to all 23 of the Spokane County fire service agencies. This descriptive research was designed to collect information so that the confined space rescue capabilities within Spokane County could be identified. The survey inquired about the training levels of personnel with NFPA 1670 and WAC definitions. It also gathered information on equipment, policy, procedures, and confined spaces within the agency's jurisdiction.

The survey included copies of WAC 296-62, Part M (2-95); WAC 296-305-05003 (7-96); NFPA 1670, and all of its referenced standards; and the Mutual Aid Agreement of Spokane County Fire Protection Authorities - 1994 Revision. A copy of the survey is included within this paper as Appendix A. The copies of the WAC, NFPA 1670, and the Mutual Aid Agreement were listed but not included in Appendix A because they comprised over 61 pages of documentation. Copies of all of the NFPA standards and statutory requirements were included with the survey because of the complexity and the recent publishing dates on some of the reference materials. NFPA 1670 for example, is a 1999 edition and some of the agencies may not have had copies.

Because of the amount of materials sent in the survey and a desire to include 100 percent of Spokane County agencies in the results, a follow-up interview was done with all 23 of the agencies. This interview followed the survey that had been sent out and allowed for a greater understanding of the issues and the responses.

The descriptive research was used to answer the research questions and the results are shown in Appendix B, which is the accumulated data from the survey and the interviews and provides a list of the equipment and training levels of personnel in Spokane County.

Limitations

The information gathered in Appendix B will only be pertinent to Spokane County and only at the time of the gathering. The capabilities of the 23 agencies is not static. Training of personnel is ongoing and the updating, development, and purchase of necessary equipment for confined space rescue continues. As a result of the survey and the follow-up interviews the process of that change has even quickened.

The statutory requirements are also continually under review. As of this writing, WAC 296-62 Part M is just beginning the hearing process for revision. This WAC is under review for the very purpose that this project was done; to identify the rescue capabilities of responding agencies. The statutory materials that were sent out with the survey and used as the basis for some of the definitions may also change. NFPA standards are under review and change on a recurring basis and the defined competencies are only as good as the most current edition.

The capabilities of the fire service agencies had no time basis; it was strictly personnel and equipment based. If a timed response criteria were included it would change the agencies capabilities.

RESULTS

Answers to Research Questions

Research Question 1: What equipment is available for confined space rescue within

the Spokane County fire service agencies?

The 23 Spokane County fire service agencies have the following confined space rescue equipment at their disposal. There are sixteen, four-gas air monitors from three different manufacturers; five electric ventilation blowers with one hundred and twenty feet of extensions; and five tripods, four of which have attachable cable winches with a maximum reach of one hundred and twenty feet. One of the tripods is used with a Uni-Hoist with an eighty-foot cabled maximum reach. The three Technical Rescue Teams all have numerous rated harnesses, hardware and rope that meet NFPA 1983 standards. All twenty-three agencies have the mandatory training required in the fire service for the use of self-contained breathing apparatus (SCBA). One agency has a supplied air respirator system (SABA) with a three hundred-foot reach.

Research Question 2: What are the fire service confined space rescue training levels in Spokane County of its personnel?

The number of trained personnel in the Spokane County, based on the requirements of NFPA 1670, are many. There are three established Technical Rescue Teams (TRT) centered in the densest populated area of the County. There are six hundred and sixty four personnel trained to the awareness level, and one hundred and four trained to the operations level. There are eighty-eight personnel trained to the technician level, all of which are on one of the technical rescue teams.

Research Question 3: What are the fire service capabilities in confined space rescue in Spokane County?

Spokane County's ability to manage a confined space rescue situation is defined by the equipment and personnel available. The county has an adequate number of trained

personnel on the established TRTs to perform confined space rescues. With the rope systems that are maintained, the personnel can reach down or out for a considerable distance; 1200 feet or more. The ability to reach down or out with cable systems is limited to 120 feet. The limitation to these reaches will be restricted by the available air supply. If the use of a SCBA system is appropriate then the limits will be that of a one-hour rated supply. If a SABA system is appropriate, the maximum reach will be 300 feet.

DISCUSSION

Confined spaces pose significant hazards within our communities. The National Traumatic Occupational Fatalities surveillance system, as reported by Suruda et al (1994), showed that over a nine year period there were 803 deaths reported in confined spaces. These confined spaces can be in any business and come in many shapes and sizes. They can be permanent structures, drafting pits, storage tanks, commercial ovens, storm drains and sprinkler vaults. They can be mobile, railroad cars, garbage trucks, lawn spray vehicles, and tank trucks (Britt, 1994; Mansdorf, 1995; Minter, 1994; Pettit, et al., 1996).

When you look at the requirements of the general occupational health standards WAC 296-62 (1995), the firefighter specific safety standards of WAC 296-305 (1996), the competencies of NFPA 1670 (1999), and the recommendation of 80 training hours for rescuers by Roop et al. (1997), it is apparent that a large commitment of resources will be needed for the fire service to maintain confined space rescue teams. Spokane County has the trained personnel and equipment needed to perform compliant rescues (See Appendix B). Those rescues will come in an area of 1764 square miles and from within 23 different fire service agencies. The bulk of the equipment and trained

personnel are centered around the three TRTs and only one of them will allow themselves to be designated as a confined space rescue team. For my organization, this study identified what help we can expect to get from our mutual aid partners and in what form, as well as what resources we might expect to send to other jurisdictions.

RECOMENDATIONS

The Spokane Valley Fire Department has a TRT and the equipment and training needed to perform confined space rescues in compliance with all the regulations. The results of this study show that we have help within our mutual aid agencies in Spokane County. The SVFD's mission is defined as all risk, that is why we are allowing ourselves to be designated as a confined space rescue team for the businesses in our jurisdiction however, that willingness to be designated as a confined space rescue team within Spokane County as a whole needs improvement. It was shown in the survey that Spokane County has a high number of trained personnel. When I interviewed the individual agencies it was clear that many were not up to date with the requirements of WAC 296-62 (1995).

Many of the smaller agencies needed to continue training their personnel at the awareness level so that they could stabilize situations until mutual aid or TRTs arrive. The three TRTs in the Spokane County need to help coordinate the training within the smaller agencies because of their expertise and experience. The results of this survey also need to be disseminated so that others understand where the resources are, and finally an education program needs to begin to help keep the agencies current with the changing statutory mandates as well as the changes in the NFPA consensus standards.

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APPENDIX A
Spokane County Confined Space Rescue Response Survey

To: Chief of Agency

From: Larry T. Rider – Division Chief
Spokane Valley Fire Department
Technical Rescue Coordinator
1-509-892-4170

Date - _____

Chief, I am conducting an analysis of the confined space rescue capabilities within the Spokane County Fire Service Agencies. I am requesting that you review the accompanying materials and return the completed personnel and equipment resource list and the questions within this letter in the enclosed envelope. If you have a technical rescue coordinator please pass this information on to him.

I do appreciate your time and the time of your staff that will be needed to complete what I am requesting. If you have any questions or if I can be of any assistance to you in the future, please don't hesitate to call. I do believe that with the growing confined space hazards in our region that this analysis will be beneficial.

Thank You, Larry T. Rider

I have included the following information for your review and as a resource.

Washington Administrative Code 296-62 Part M (2-95) Confined Spaces

Washington Administrative Code 296-305-05003 (7-96) Confined Space Rescue Operations

NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents 1999 Edition, Chapter 5 – Confined Spaces and Referenced Standards

Mutual Aid Agreement of Spokane County Fire Protection Authorities - 1994 Revision

Survey Questions

General Information

Contact person for your confined space rescue program? _____

Phone number? _____

Are you allowing yourself to be designated as a contract rescue service? _____

APPENDIX A
Spokane County Confined Space Rescue Response Survey

Are you going to respond to confined space rescue emergencies from non-contracted spaces? _____

Do you have policy and procedures for confined space rescue?
_____

Are you compliant with the training requirements of WAC 296-62 Part M? _____

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Do you have any permit required confined spaces on your facilities?
_____

Are you compliant with WAC 296-62 Part M (2-95) for your own permit required confined spaces? _____

If you do not have a confined space rescue team and you have permit required confined spaces on your facilities, who have you designated as your rescue agency?

Training requirements based on WAC 296-305-05003 and WAC 296-62 Part M, confined spaces.

How many personnel have authorized entrant training? _____

Are they trained in their assigned rescue duties? _____

Are they trained in the use of their personal protective equipment and rescue equipment? _____

Do they practice a simulated rescue every 12 months in a representative spaces?
_____

Do the have basic first aid and CPR training? _____

Training requirements are based or the performance standards of NFPA 1670.

How many personnel are trained to the **Awareness** level? _____

How many personnel are trained to the **Operations** level? _____

How many personnel are trained to the **Technician** level? _____

APPENDIX A
Spokane County Confined Space Rescue Response Survey

Equipment Resources

Air monitoring equipment for, Oxygen, Combustible gases, Toxic gases.

How many? _____

Manufacturer? _____

Ventilating equipment.

How many? _____

Manufacturer? _____

Hose extensions for ventilation equipment, how many feet? _____

Communication equipment.

Radio. _____
Hard wire. _____
Other. _____
Intrinsically safe? _____

Lighting equipment.

Head lamps. _____
Flash lights. _____
Other. _____
Intrinsically safe? _____

Tripod.

Manufacturer? _____

Retrieval Systems.

Unihoist. _____
Winch. _____
Rope. _____

Cable retrieval systems reach.

Feet? _____

Air supplies.

Supplied air respirator. _____
Reach. _____
Self-Contained Breathing Apparatus.
Duration. _____

APPENDIX B
Spokane County Confined Space Rescue Resources and Capabilities

Confined Space Resources

All 23 Spokane County Fire Service Agencies included.

Technical Rescue Teams

Teams	3

Personnel Trained – NFPA 1670 Standard

Personnel trained to the Awareness level	664
Personnel trained to the Operations level	104
Personnel trained to the Technician level	88

Confined space rescue equipment available

Air monitoring units, 4 gas.	16	
Ventilating blowers.	5	
Blower extensions.	120’	
Intrinsically safe communication systems.	4	
Tripods	5	
Uni-hoist	1	80’ cable
Winches	4	120’ cable
Rope Systems	All of the Technical Rescue Teams are fully equipped and compliant on their ropes, harnesses and training.	
Supplied air respirators	1	300’ extension
Self-Contained Breathing Apparatus	All 23 agencies are equipped and trained with SCBA	

APPENDIX B
Spokane County Confined Space Rescue Resources and Capabilities

Other information gathered form the survey.

Do you have policy and procedures for confined space rescue?

Yes - 14
No - 9

Are you going to respond to confined space rescue emergencies?

Yes - 23
No - 0

Do you have any permit required confined spaces on your own facilities?

Yes - 8
No - 15

Are you compliant with the training requirements of WAC 296-62 Part M?

Yes - 4
No - 19

Are you allowing yourself to be designated as the confined space rescue service?

Yes - 1
No - 22